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What are our Customers Reading? An Analysis of the Most Frequently Used Subjects of the NIST Research Library Book Collection Based on Circulation

Hassler, Harriet

U. S. DEPARTMENT OF COMMERCE
Technology Administration
National Institute of Standards
and Technology
Information Services Division
Gaithersburg, MD 20899-8230

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U.S. DEPARTMENT OF COMMERCE
Carlos M. Gutierrez, Secretary

TECHNOLOGY ADMINISTRATION
Phillip J. Bond, Under Secretary for Technology

NATIONAL INSTITUTE OF STANDARDS
AND TECHNOLOGY
Hratch G. Semerjian, Acting Director

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Executive Summary

This report analyzes circulation data for the NIST Research Library book collection to determine the most used subjects. Books are grouped into subjects using their call numbers, and subjects are ranked by usage at the broad class, subclass, and specific topic level. The most circulated individual titles are also given. Tables showing rankings are given in Appendix A.

Research for this report was initiated in fiscal year 2003 as part of an Information Services Division (ISD) review of the book acquisitions processes of the NIST Research Library. The review showed that the Library received via its book approval plan almost twice as many books as it purchased. To tighten the approval plan profile to more closely match actual purchasing and reduce returns, Library staff determined to report on usage patterns in the book collection based on circulation statistics. It was hoped that the resulting report could be used to tighten the profile controlling automatic book delivery, and to serve as a general aid to the book selection process by giving Library staff one tool with which to predict the value of a purchase in terms of actual customer usage.

Methodology

Data in this study are based on a report from the Library's integrated library system (ILS) capturing all titles in the book collection that had been used since the beginning of fiscal year 2002 (October 1, 2001) through the date the ILS report was run (February 6, 2004), a 28-month period. The report provided total circulation transactions for each title.

The subject of each book was determined using its call number. Library call numbers are created following the Library of Congress Classification (LCC) system. LCC divides the universe of knowledge into twenty-one top-level classes using alphabetic characters. Classes are broken down into subclasses, divisions, and topics using an expanded alphanumeric notation.

To create the tables for this report, titles were grouped using the LCC structure into successively more narrow categories, beginning with the top level LCC class, and working down through the subclasses to the specific call number level, denoting a specific topic.

The ILS report included 12 594 titles that circulated during the period of the study. These titles, called All Books in this report, were grouped by call number into increasingly more specific categories and each category was scored according to the formula:

ALL BOOKS SCORE = (CIRCULATION TRANSACTIONS x CIRCULATED VOLUMES) / 1000.

The scoring system was devised to create a single number that gave weight to both total circulation transactions and total number of volumes circulated.

The analysis was repeated separately for the subset of books published from 1999 to 2004, called New Books in this report. There were 1157 New Books used in the period of study. New Books were scored using a similar formula:

NEW BOOKS SCORE = (CIRCULATED TRANSACTIONS x CIRCULATED VOLUMES) / 100.

The total number of available books was also recorded for each call number using the ILS reporting capabilities. This number was converted to a usage percentage using the formula:

USAGE RATE = (CIRCULATED VOLUMES / AVAILABLE VOLUMES) x 100

Data limitations include the necessity of setting a minimum number of circulated volumes threshold for qualifying call numbers for scoring. For All Books (Table 3), the scoring threshold was 24 volumes per call number. For New Books (Table 4), the threshold was 3 volumes per call number.

Ranking of Classes and Subclasses (Tables 1 and 2)

The most used top-level classes are Science (Q), Technology (T), and Medicine (R) (Table 1). These results are expected given the focus of NIST on Science and Technology. The most popular subclasses are Physics, Mathematics, Chemistry, General Engineering, and Computer Science (Table 2).

Ranking of Call Numbers (Tables 3 to 5)

Tables 3 and 4 show call numbers ranked by score, with subject area and specific topic, both drawn from the LCC schedules. Table 3 covers All Books. Table 4 covers New Books (1999-2004). In Table 4, topics shown in shade are topics that did not appear in Table 3 covering All Books. These should be considered emerging topics of interest to the NIST community in the period 1999-2004 (see below).

Table 5 organizes call numbers from Tables 3 and 4 by subject. The table shows Programming, Software, Computer Systems and Special Computing, Probabilities, Statistics, Mathematical Analysis, Atomic Physics, Electricity, Analytical Chemistry, Organic Chemistry of Polymers, Physical and Theoretical Chemistry, Materials of Engineering, Telecommunication, and Electronics are the most frequently used subject areas in the book collection.

Most Popular Subclasses

At the specific call number level, in the number 1 ranked subclass, Physics, the most used topics are Spectroscopy, Solids and Solid State Physics, Particle Physics, Mathematical Physics, Semiconductor Physics, and Quantum Theory and Mechanics.

For the number 2 ranked subclass, Mathematics and Statistics, the most used topics are Mathematical Statistics, Probabilities, Nonparametric Methods, Numerical Analysis, Regression and Correlations Analysis, and Multivariate Analysis.

For the number 3 ranked subclass, Chemistry, the most used topics are Spectrum Analysis and Spectroscopy, Inorganic Elements, Polymers, Atomic and Molecular Theory and Structure, and Chromatographic Analysis.

The Technology class accounts for five of the top ten subclasses in Table 2: General Engineering, Electrical Engineering, Mechanical Engineering, Chemical Technology, and Telecommunications. The most used topics are Polymers as a Material of Engineering, Semiconductors, Microelectronics, Special Processes, Metallography, and Robotics.

Specific Subjects of Note

Several subjects deserve special mention for their notable high use. These are Spectroscopy, Information Technology and Computer Science, Polymers, and NIST Strategic Focus Area (SFA) topics.

Spectroscopy was by far the most used subject in the collection when looking at All Books (Table 3, nos. 1 and 2), and was also important when looking at New Books (Table 4, nos. 9 and 23). Spectroscopy is a highly used subject area both in the discipline of Chemistry and in the discipline of Physics.

Information Technology and Computer Science account for multiple entries on the tables for All Books (Table 3), New Books (Table 4), and most circulated individual titles (Tables 6 and 7). Among the most popular topics are Operating Systems, Java, Hypertext Systems, Software Topics, Computer Topics, Database Management, Computer-aided Engineering, Programming Languages, Computer Graphics, Object-oriented Computing, C Programming Languages, Quantum Computing, Client/Server Computing, Database Design, and Visual Basic. Telecommunications also accounted for several popular topics including World Wide Web, Signal Processing, TCP/IP, and Active Server Pages.

Polymers accounted for four out of seventeen top Chemistry call numbers (see Table 5, QD), and also occurred as popular topics in the disciplines of Physics, Medicine, Materials Science, and Chemical Engineering. This fits with the fact that during the period of study the Polymers Division within the Materials Science and Engineering Laboratory (MSEL) was the division with the highest circulation level among all divisions at NIST.

NIST SFAs of Nanotechnology, and Healthcare/Biotechnology are readily apparent in the lists of high use topics. From Table 5, they are specifically addressed by the topics Biomedical Engineering, Biomedical Materials, Nanotechnology, Nanostructure Materials, Microelectronics, and Microelectromechanical Systems. Other popular topics with applications in SFA research include Surfaces, Quantum Mechanics, Solid State Physics, Spectroscopy, Semiconductors, Polymers, Scanning Microscopes, Biochemistry, Robotics, and Control Engineering.

Emerging Topics of Interest

Topics that rank among the most popular for New Books (Table 4) but which are not on the list for All Books (Table 3) are considered emerging topics of interest. These emerging topics are Nanostructure Materials, Nanotechnology, Bayesian Statistics, Signal Processing, Microelectromechanical Systems (MEMS), TCP/IP, Active Server Pages, Biomedical Materials, Object-Oriented Computing, Quantum Computing, Client/Server Computing, Carbon as a Material in Engineering, Special Topics in Research, Special Types of Polymers, Database Design, and Visual Basic Programming. Almost all relate directly to the NIST SFAs of Nanotechnology, Biotechnology, and Information/Knowledge Management.

Analysis of Most Circulated Individual Titles (Tables 6 and 7)

Table 6, Top 30 Most Circulated Titles for All Books, shows individual titles with the greatest number of total circulation transactions (in-house uses and checkouts combined). Books with subjects shown in bold are on topics whose popularity is predicted by appearance on Table 5. Programming, in particular C/C++, accounts for the largest number of most circulated books. Many of the most circulated popular books are textbooks, including many older classics.

Table 7, Top 30 Most Circulated Titles for New Books (1999-2004), shows individual books published in 1999 or later with the greatest number of total circulation transactions (in-house uses and checkouts combined). Books with subjects shown in bold are on topics whose popularity is predicted by appearance on Table 5. Again, Programming is the most represented area, including Visual Basic, Java, and Object-Oriented.

Relation to the NIST Research Library Customer Survey

The NIST Research Library customer survey conducted in 2001 supports the findings of this report that the book collection is valued and used. High use subjects in the customer survey were Physics, Engineering, Chemistry, Computers/Information Technology, Materials Science, and Mathematics. These are consistent with high use subjects identified in this report. High use types of resources in the customer survey included conference proceedings, textbooks, and technical books, all of which are generally part of the book collection and procured with the Library's book budget. However,

satisfaction with technical books, textbooks and conference proceedings was relatively low. The survey report stated that these collections should be improved.

In the customer survey, textbooks scored in the "very high use" category. This agrees with the findings of this report that show textbooks are the most circulated items in the Library. The Library should purchase textbooks that are rated favorably by Subject Specialists and which support NIST research. The Library should also be proactive in checking for the availability of new editions of textbooks that have proved popular in the past.

Relation to the Core Journals List

In 2002, the NIST Research Library developed a core journals list with input from each of the divisions in the NIST Laboratories. The core journals list is categorized by subjects most similar to those shown on Table 2, NIST Modified Subclasses Ranked by Score. Based on number of titles per category, core journals rank by subject as follows, from highest to lowest: Engineering, Physics, Chemistry, Materials Science, and Computer Science. As shown in Table 2, subclasses rank by circulation as follows, from highest to lowest: Physics, Mathematics, Chemistry, General Engineering, and Computer Science.

The two lists roughly correlate but show some differences. Some of these differences are attributable to different methods of categorization in the two lists. For instance, in this report Materials Science was not a separate category but fell under General Engineering. Mathematics stands out strongly as a high use category in this study, but only ranked sixth on the core journals list. Clearly, users turn to the Library book collection for information on Mathematics a great deal, but few divisions considered Mathematics as a "core" research area when it came to the journal collection.

Recommendations for the Library Approval Plan Profile

The Library's approval plan profile controls by topic which books are sent to the Library for review automatically. The automatic delivery of books on the approval plan is an important part of the acquisition process. Through this method, books that are most pertinent to the research needs of the organization arrive without any proactive effort required by Library staff or Subject Specialists. However, in order for the approval plan to work as intended, the Library must have a book budget that roughly corresponds to the number of books that are sent on approval. When the Library's book acquisitions drop below 500 titles per year, the approval plan becomes difficult to operate. For fiscal years 2004 and 2005, automatic delivery has been temporarily suspended due to budget constraints.

In general, the NIST book approval plan profile is well tailored to the needs of the organization. When activated, automatic book delivery is currently concentrated in Physics, Chemistry, General Engineering, Mechanical Engineering, and Telecommunications. However, following the findings of this report, the profile should be refined by adding more coverage for popular areas in Mathematics and Computer Science, Biochemistry, and Biomedical Engineering. Book shipment should be reduced in the lesser-used areas of Physics, Chemistry, Technology and Engineering; the Library would continue to be notified of newly published works in these areas by receiving a slip describing the book in place of the physical volume.

Conclusions

Through the customer survey and through circulation patterns shown in this report, Library customers have stated that the book collection is an important and highly used resource. This report provides an outline of subject areas in which collection development will almost certainly result in resources that are highly used and generate substantial return on investment (ROI). These subjects include but are not limited to NIST SFAs. They also include many subjects of broad interest to the research community, such as spectroscopy, and of practical utility to bench scientists, such as computer programming.

The results of this report suggest that NIST staff use the book collection to learn about topics that *support* their research, such as programming, research methodology, and statistical analysis, as much if not more than to learn about their specific areas of expertise. Studies of information use by scientists have shown that journals, not books, are the single most important information resource for maintaining current awareness in the fields of science and engineering. At NIST, this study suggests that the book collection is more likely to be used to investigate fields in which the scientist is less familiar, but in which a situational need for more knowledge has occurred. Among the most popular books in the collection are a number of classic textbooks, supporting the thesis that the Library should view the book collection not only as a resource for subject experts, but also for non-experts coming in from outside a discipline to get an introduction to a new topic.

In recent fiscal years, budget cuts to the Library have made collection development challenging. As the Library continues to operate with a limited book budget, it is paramount that titles purchased are effective and utilized. The Library can aim to achieve high usage of new acquisitions by close monitoring of circulation of existing resources by its customers. This study represents one attempt to do such monitoring.

This report illuminates popular subject areas. High usage rates in many of these subjects, especially for new books, shows that the Library's acquisition program has been successful. The Library has identified what its customers are reading and knows what it should be buying. The Library is ready to make sound purchasing decisions and to measure its performance. The Library book collection should continue to be funded to maintain and improve its current level of success and customer satisfaction.

1. Introduction

This report analyzes circulation data for the NIST Research Library Book Collection in fiscal years 2002, 2003, and part of 2004 to determine the most used subjects in the collection. Books are grouped into subjects using their call numbers (see section 2.2 for further discussion), and ranked by usage. In Appendix A, rankings are given by broad class and subclass (Tables 1 and 2), and by specific topic (Tables 3-5). Table 3 covers all books that circulated within the period of study. Table 4 covers only those books published between 1999 and 2004 that circulated within the period of study. Table 5 shows the top call numbers arranged by subject rather than ranking. The most circulated individual titles are also given (Tables 6 and 7).

This report was initiated in fiscal year 2003 when the Information Services Division (ISD), which includes the NIST Research Library, tasked two librarians to review the book acquisitions processes. This review included an assessment of the book approval plan with the Library's current book vendor. According to the Library's profile with the vendor, books in certain subjects are sent automatically without being specifically ordered. The review showed that the Library only purchased about half of these books. In addition, of all books purchased, only 15 % were originating from the automatic book shipments. The high rate of return placed cost and time burdens on the Library's staff, as well as on the vendor's. In looking for ways to tighten the profile to more closely match actual purchasing, an assessment of Library customers' usage became an area of interest for investigation. Library staff therefore determined to report on usage patterns in the book collection based on circulation statistics. It was hoped that the resulting report could be used to tighten the profile with the vendor to include only those topics of very high interest to Library customers. It was also hoped that the resulting report could serve as a general aid to the book selection process by giving Library staff one tool with which to predict the value of a potential purchase in terms of actual customer usage.

2. Methodology

2.1 Source of Data

This study is based on a report from the circulation module of the Library's integrated library system (ILS) produced on February 6, 2004. The report captured all titles that had been used since the beginning of fiscal year 2002 (October 1, 2001) through the date the ILS report was run (February 6, 2004), a 28-month period. The report looked only at the book collection and excluded circulation of titles in the journal collection. For each title, the report included call number, date last used, number of in-house uses, number of checkouts, and total number of circulation transactions (in-house uses and checkouts combined). An in-house use is counted when a book is taken from the shelf by a customer and left in the Library; it is recorded in the ILS by Library staff before the item is reshelved. Although a book had to have been used within the 28-month period to appear on the report, the number of in-house uses and checkouts included all activity going back to the implementation of the automated circulation system in August 1991. The ILS does not support reporting on use for an individual item within a specified time period. Therefore, throughout this report, the reader should keep in mind that every book included had circulated at least once during fiscal years 2002-2004; however, total circulation transactions were calculated over the period 1991 to February 2004.

2.2 Use of Call Numbers

A call number is a mark of notation used to arrange books by subject. The first part of a call number is the class notation, which identifies the subject of the book. The second part is the book number, which uniquely identifies an item and is used to arrange books within a topic in a meaningful way, usually by author. For the purposes of this study, the term "call number" refers to the class notation only. The NIST Research Library uses Library of Congress Classification (LCC) to create call numbers. LCC divides the universe of knowledge into twenty-one top-level classes using alphabetic characters. Classes are broken down into subclasses and divisions using an expanded alphanumeric notation.

For example, the top ranking call number on Table 3 is QD96, which represents:

Q for Science (Class)
QD for Chemistry (Subclass)
QD71-QD142 for Analytical Chemistry (Subject Division)
QD96 for Spectrum Analysis, Special Methods and Types (Topic)

Some topics are further subdivided into more specific subtopics using a "Cutter" number (named after the system of subdivision's creator, Charles A. Cutter), which is a second letter-number string following the base class number. For example, the top ranking call number on Table 4 is QA76.76 .O63, which uses the Cutter number .O63 and represents:

Q for Science (Class)
QA for Mathematics (Subclass)
QA71-QA90 for Instruments and Machines (Subject Division)
QA76.76 for Computer Software, Special Topics (Topic)
QA76.76 .O63 for Operating Systems (Subtopic shown by Cutter number)

To create the tables for this report, titles were grouped using the LCC structure into successively more narrow categories, beginning with the top level LCC class, and working down through the subclasses to the specific call number level.

2.3 Scoring for All Books

The ILS report included 12 594 books that circulated during the period of the study. There were 216 083 circulation transactions for these materials (in-house uses and checkouts). These titles, called All Books in this report, were grouped by call number into increasingly more specific categories and each category was scored. The score was calculated by multiplying the total circulation transactions by the number of circulated volumes, then dividing by 1000:

SCORE = (CIRCULATION TRANSACTIONS x CIRCULATED VOLUMES) / 1000.

The scoring system was devised to create a single number that gave weight to both total circulation transactions and total number of volumes circulated. Thus, given two call numbers with equal numbers of transactions, the call number that had more circulated volumes would outscore the other.

Where call numbers used Cutter numbers to denote subtopics, if the Cutter number qualified for scoring independently, the subtopic was scored separately. If the call number had Cutter numbers but none qualified for scoring independently, then the call number was scored as a whole without regard to Cutter numbers. As discussed in section 2.5, to qualify for scoring, a call number had to have 24 or more titles circulated for All Books, or 3 or more titles circulated for New Books.

The total number of available books was also recorded for each call number using the ILS reporting capabilities. This number was converted to a usage percentage using the formula:

USAGE RATE = (CIRCULATED VOLUMES / AVAILABLE VOLUMES) x 100

2.4 Scoring for New Books

The analysis was repeated separately for the subset of books published from 1999 to 2004, called New Books in this report. Since these books could not have been used prior to 1999, this analysis was intended to isolate the most current and emerging interests of Library customers. Again categories were scored. The formula was the same as for All Books, except that, because numbers were smaller (there were roughly 10 times fewer books), the product of total circulation transactions and total circulated volumes was divided by 100 rather than by 1000:

SCORE = (CIRCULATION TRANSACTIONS x CIRCULATED VOLUMES) / 100.

There were 1157 New Books published in 1999 or later used in the 28-month period of study, with 13 306 total circulation transactions. According to the ILS, there were approximately 2 000 books published in 1999 or later available for circulation when the usage data was collected. This suggests that many new books did not circulate, however, due to data limitations, only limited conclusions should be drawn from this. Not all new books were purchased; some were gifts. Also, the length of time each new book had been available varied; some had only been available for checkout a short period. A valid measure of usage of purchased new books requires a separate analysis using more targeted data.

2.5 Qualifications to the Data

Call numbers were only considered for inclusion in the Top 100 Call Numbers for All Books list (Table 3) if 24 or more individual titles in that call number had circulated in the period of study. It was beyond the time resources available for this report to score every call number; therefore, a threshold had to be set. Because of the threshold, the analysis may favor those call numbers in which the collection was already strong. A call number of high interest in which the Library had not collected adequately may not have made it into the report because it did not meet the threshold of 24 items. The threshold for the Top 50 Call Numbers for New Books list (Table 4) was much more easily attainable at 3 items. Table 5, in which Top Call Numbers are arranged by subject, is intended to

reduce bias by looking beyond individual call numbers to broader subject ranges illuminating wider areas of high interest to customers.

The ILS report provided total circulation transactions per volume but the system is unable to provide total number of users per volume. Therefore, this report could not take into account the fact that some titles attain a high number of transactions by being renewed multiple times by a singer user. For this report, each renewal counted as one transaction.

To maintain the privacy of library users, the ILS does not keep a history of the activity of individual users. No records pertaining to any individual users were obtained or analyzed for this report.

3. Ranking of Classes and Subclasses (Tables 1 and 2)

Table 1, LCC Classes Ranked by Score, shows that the Q class representing Science is by far the most popular class, followed by the T class, representing Technology. The class R, for Medicine, is a distant third. These results are expected given the focus of NIST on Science and Technology.

For Table 2, NIST Modified Subclasses Ranked by Score, LCC classes were broken down into smaller subclasses, scored and ranked. Subclasses on Table 2 are modified from LCC in some cases based on local interests and usage. For instance, the subclasses Physics and Chemistry match the top-level breakdown of the LCC Q schedule: QC for Physics, QD for Chemistry. However, the subclass QA, titled Mathematics in LCC, was broken down into two parts, Mathematics and Computer Science, for this report since Computer Science traditionally has been treated as a separate subject area by the NIST Research Library.

The results show the top five most popular subclasses are Physics, Mathematics, Chemistry, General Engineering, and Computer Science. In Medicine, the most popular subclass is Bioengineering. In Social Sciences, the most popular subclass is Management.

The high use of Physics, Chemistry, and Engineering is expected since these subjects clearly correspond to research specialties of the NIST Laboratories. Less expected is the high use of Computer Science and Information Technology related books, including books on programming languages and software. These are not only high use subjects, but account for many of the most popular individual titles as well. These results are less expected because the Information Technology Laboratory (ITL) ranks only fourth among Laboratories for use the book collection.[1] However, Computer Science and Information Technology are intrinsically part of all types of scientific research today. This accounts for the high usage of books on these subjects.

Mathematics is a surprisingly highly used subclass because, unlike Physics or Chemistry, Mathematics is not a core research area associated with a particular NIST Laboratory, although ITL includes divisions for Mathematical and Computational Sciences and for Statistical Engineering. Factors contributing to the high usage of Mathematics include its relevancy and applicability to all types of research. Also, studies have shown that mathematicians use monographs and cite older materials more than scientists in other disciplines, which points to greater utilization of the book collection in the area of Mathematics.[2]

[1] For fiscal year 2003, from data collected by NIST Research Library integrated library system, book circulation by NIST Laboratory ranked as follows based on number of checkouts: 1. MSEL (28%), 2. PL (20%), 3. CSTL (16%), 4. ITL (11%), 5. MEL (9%), 6. BFRL (7%), 7. EEEL (4%), 8. TS (1%),

[2] Cecelia M. Brown, Information seeking behavior of scientists in the electronic information age: astronomers, chemists, mathematicians, and physicists, J. Am. Soc. Inf. Sci. **50** (10), 929-943 (1999).

4. Ranking of Call Numbers (Tables 3 to 5)

To produce Table 3, Top 100 Call Numbers for All Books Ranked by Score, books from the circulation report were grouped by call number. Call numbers that had more than 24 individual volumes represented were selected for scoring. Call numbers are shown ranked by score, with subject area and specific topic, both drawn from the LCC schedules.

Table 4, Top 50 Call Numbers for New Books (1999-2004) Ranked by Score, only considered books that had been published in 1999 or later. For Table 4, a call number only had to have 3 or more titles in order to qualify for scoring. In Table 4, topics shown in shade are topics that did not appear in Table 3 covering All Books. These should be considered emerging topics of interest to the NIST community in the period 1999-2004 (see section 7).

Many subjects on Table 4 also showed very high usage rates, approaching or reaching 100%. Where this is true, it indicates that almost every book the Library owned on that subject was used.

Table 5, Top Call Numbers Arranged by Call Number, organizes call numbers from Tables 3 and 4 by subject. Table 5 is intended to place high use call numbers within a broader context to reveal what subject areas are of greatest interest to customers. The table shows Programming, Software, Computer Systems and Special Computing, Probabilities, Statistics, Mathematical Analysis, Atomic Physics, Electricity, Analytical Chemistry, Organic Chemistry of Polymers, Physical and Theoretical Chemistry, Materials of Engineering, Telecommunication, and Electronics are among the most frequently used subject areas in the book collection.

5. Most Popular Subclasses

5.1 Physics (QC)

The call number subclass for Physics, QC, is the most used subclass in the book collection. Major subject areas of interest are Atomic Physics, Optics, and Electricity. From Table 3, Top Physics topics include (in rank number order):

Spectroscopy / QC454 (no. 2)
Solids and Solid State Physics / QC176, QC176.8 (nos. 4 and 17)
Particle Physics / QC793.5 (no. 8)
Mathematical Physics / QC20.7 (no. 18)
Semiconductor Physics / QC611.6 (no. 19)
Quantum Theory and Mechanics / QC174.12 (no. 21)

5.2 Mathematics and Statistics (QA)

Books in the QA class, covering Mathematics, show very high usage. Mathematics has higher circulation numbers than Chemistry, even excluding computer science books, which are also in QA, from the Mathematics category. From Table 3, Top Mathematics and Statistics topics include (in rank number order):

Mathematical Statistics, General / QA276 (no. 6)
Probabilities, General / QA273 (no. 7)
Nonparametric Methods / QA279 (no. 24)
Numerical Analysis / QA297 (no. 25)
Regression and Correlations Analysis / QA278.2 (no. 27)
Multivariate Analysis / QA278 (no. 30)

5.3 Chemistry (QD)

The subclass QD for Chemistry is the third most used subclass after Physics and Mathematics. Major subject areas of interest are Analytical Chemistry, Organic Chemistry, and Physical and Theoretical Chemistry. From Table 3, Top Chemistry topics include (in rank number order):

Spectrum Analysis, Spectroscopy QD96 (no. 1)
Inorganic Elements / QD181 (no. 10)
Polymers / QD381, QD381.9 (nos. 12 and 40)
Atomic and Molecular Theory and Structure / QD461 (no. 16)
Chromatographic Analysis / QD79.C4-.C8 (no. 31)

5.4 Engineering/Technology (T)

The class T accounts for five of the top ten subclasses in Table 2: General Engineering (TA), Electrical Engineering (TK pt.1), Mechanical Engineering (TJ), Chemical Technology (TP), and Telecommunications (TK pt. 2). Major subject areas of interest are Materials of Engineering, Engineering Mathematics, Robotics, and Electronics. From Table 3, top Technology and Engineering topics include (in rank number order):

Polymers as a Material of Engineering / TA455 .P58 (no. 9)
Semiconductors / TK7871.85 (no. 11)
Microelectronics / TK7874 (no. 22)
Special Processes / TP156 (no. 23)
Metallography / TN690 (no. 33)
Robotics / TJ211 (no. 34)

6. Specific Subjects of Note

6.1 Spectroscopy

Spectroscopy was by far the most used subject in the collection when looking at All Books (Table 3). It was also important when looking at New Books (Table 4). The number 1 and number 2 ranked call numbers for All Books both dealt with spectroscopy. The call number QD96, in the subject area Analytical Chemistry, covers special types of spectroscopy including infrared, mass, and nuclear magnetic resonance. The call number QC454, in the area of Optics, covers different types of spectroscopy such as electron, laser, and molecular. Spectroscopy is a highly used subject area both from a Chemistry perspective and from a Physics perspective.

6.2 Information Technology and Computer Science

Information Technology and Computer Science account for the most used subjects in the collection when looking at New Books (Table 4). They are also very important when looking at All Books (Table 3). Two of the top five call numbers for All Books and four of the top five call numbers for New Books cover information technology and computer-related topics. These types of topics appear frequently throughout Tables 6 and 7, listing most circulated individual titles. C programming language books in particular are high-circulating items. From Table 4, the most popular call numbers include (in rank number order):

Operating Systems (Windows, Linux, etc.) / QA76.76 .O63 (no. 1)
Java / QA76.73 .J38 (no. 2)
Hypertext Systems (HTML, XML, etc.) / QA76.76 .H94 (no. 3)
Software Topics (Development, Testing, etc.) / QA76.76 (no. 8)
Computer Topics (Security, Simulation, Natural Language, etc.) / QA76.9 .A25 (no. 10)
Database Management / QA76.9 .D3 (no. 11)
Computer-aided Engineering / TA345 (no. 14)
Programming Languages, General / QA76.73 (no. 17)
Computer Graphics / T385 (no. 31)
Object-oriented Computing / QA76.9 .O35 (no. 35)
C Programming Languages / QA76.73 .C15 (no. 36)
Quantum Computing / QA76.889 (no. 40)
Client/Server Computing / QA76.9 .C55 (no. 42)
Database Design / QA76.9 .D26 (no. 49)
Visual Basic / QA76.73 .B3 (no. 50)

The field of Telecommunications also includes a number of popular IT-related call numbers including (in Table 4 rank number order):

World Wide Web / TK5105.888 (no. 4)
Signal Processing / TK5203.59 (no. 16)
TCP/IP / TK5105.585 (no. 29)
Active Server Pages / TK5105.8885 .A26 (no.30)

6.3 Polymers

Several high use call numbers deal with the subject of Polymers. This fits with the fact that during the period of study the Polymers Division within the Materials Science and Engineering Laboratory (MSEL) was the division with the highest circulation level among all divisions at NIST.[3] Polymers as a topic are covered within several different disciplines, including Chemistry, Physics, Medicine, and Engineering. Most prominently in the class Chemistry (QD), Polymers account for 4 of the 17 top call numbers shown in Table 5, including (in call number order):

Polymerization and Telomerization / QD281 .P6
Polymers, General / QD381
Special Topics (electric properties, solubility, surfaces, rheology, etc.) / QD381.9
Special Types of Polymers (conductors, crystalline, water-soluble, etc.) / QD382

Outside Chemistry, Polymers also occur as a facet in other disciplines. Polymers are included as subtopics in the following call numbers from Table 5 (in call number order):

Atomic Physics - Matter and Antimatter / QC173.4
Biomedical Engineering / R857
Materials of Engineering / TA455 .P58
Chemical Engineering / TP156)

6.4 Strategic Focus Areas (SFAs)

NIST SFAs of Nanotechnology, and Healthcare/Biotechnology are readily apparent in the lists of high use topics. From Table 5, they are specifically addressed by the following topics (in call number order):

Biomedical Engineering (R857)
Biomedical Materials (R857 .M3)
Nanotechnology (T174.7)
Nanostructure Materials (TA418.9 .N35)
Microelectronics (TK7874)
Microelectromechanical Systems (TK7875)

Other popular topics with applications in SFA research include (from Table 5, in call number order):

Surfaces (QC173.4 .S94)
Quantum Mechanics (QC174.12, QC174.17)
Solid State Physics (QC176, QC 176.8)
Spectroscopy (QC454, QD96)
Semiconductors (QC611, QC611.6, QC612 .S4, TK7871.85)
Polymers (QD281 .P6, QD381, QD381.9, QD382)
Scanning Microscopes (QH212 .S3x)
Biochemistry (QP519.9)
Robotics (TJ211)
Control Engineering (TJ213)

[3] Based circulation data collected from the NIST Research Library ILS covering fiscal year 2003.

7. Emerging Topics of Interest

Topics that rank among the most popular for New Books (Table 4) but which are not on the list for All Books (Table 3) are considered emerging topics of interest. These emerging topics, shown in shade on Table 4, include (in rank number order):

Nanostructure Materials / TA418.9 .N35 (no. 5)
Nanotechnology / T174.7 (no. 12)
Bayesian Statistics / QA279.5 (no. 13)
Signal Processing / TK5102.9 (no. 16)
Microelectromechanical Systems (MEMS) / TK7875 (no.18)
TCP/IP / TK5105.585 (no.29)
Active Server Pages / TK5105.8885 .A26 (no. 30)
Biomedical Materials / R857 .M3 (no. 33)
Object-Oriented Computing / QA76.9 .O35 (no. 35)
Quantum Computing / QA76.889 (no.40)
Client/Server Computing / QA76.9 .C55 (no.42)
Carbon as a Material in Engineering / TA455 .C3 (no.43)
Research, Special Topics (Methodology, Proposal Writing, etc.) / Q180.55 (no.46)
Polymers, Special Types / QD382 (no. 47)
Database Design / QA76.9 .D26 (no.49)
Visual Basic Programming / QA76.73 .B3 (no.50)

Almost all relate directly to the NIST SFAs of Nanotechnology, Biotechnology, and Information/Knowledge Management.

8. Analysis of Most Circulated Individual Titles (Tables 6 and 7)

Table 6, Top 30 Most Circulated Titles for All Books, shows individual books with the greatest number of total circulation transactions. Total transactions were counted from August 1991 onward, however every book circulated at least once between October 2001 and January 2004. Books with subjects shown in bold are on topics whose popularity is predicted by appearance on Table 5. Twenty-seven of thirty books are in subject areas appearing on Table 5. Twelve of thirty are on specific topics appearing on Table 5. Programming, in particular C/C++, accounts for the largest number of most circulated books.

Even though all usage that was counted to produce Table 6 occurred from 1991 onwards, many of the books were published substantially before 1991. Many older books continue to circulate regularly. These are mostly textbooks. Among the titles that could be considered "classic" textbooks are Draper and Smith's *Applied Regression Analysis* (Table 6, no. 2), Press's *Numerical Recipes: the Art of Scientific Computing* (Table 6, no. 5), and Westcott's *pH Measurements* (Table 6, no. 16). Each of these is currently owned by over 800 libraries in the U.S. according to the WorldCat database maintained by the Online Computer Library Center (OCLC).

Table 7, Top 30 Most Circulated Titles for New Books (1999-2004), shows individual books published in 1999 or later with the greatest number of total circulation transactions. Books with subjects shown in bold are on topics whose popularity is predicted by appearance on Table 5. Twenty-eight of thirty books are in subjects appearing on Table 5. Fourteen of thirty are on specific topics appearing on Table 5. Programming is the most represented area, including Visual Basic, Java, and Object-Oriented.

9. Relation to the NIST Research Library Customer Survey

The fact that 12 594 individual titles circulated within the 28-month period of study proves that the book collection is a valuable resource in which NIST should continue to invest. The NIST Research Library customer survey conducted in 2001 also supports this conclusion. High use subjects reported in the survey were Physics, Engineering, Chemistry, Computers/Information Technology, Materials Science, and Mathematics. These are consistent with high use subjects identified in this report. High use types of resources in the survey included conference proceedings, textbooks, and technical books, all of which are generally part of the book collection and procured with the Library's book budget. These were also reported to be of great value by 50% or more of respondents. However, satisfaction with technical books, textbooks and conference proceedings was relatively low. There were several comments about the importance of these collections, and about the need for more and newer textbooks. The survey report stated that these collections should be improved.[4] Customers liked the quality and scope of the Library collection, but felt there were not enough resources.

In the customer survey, textbooks scored in the "very high use" category. This agrees with the findings of this report that shows textbooks are the most circulated items in the Library. The Library of Congress has defined textbook as "a work that presents a particular subject in an organized and simplified manner and is explicitly intended to be used for the purpose of learning that subject."[5] The Library should purchase textbooks that are rated favorably by Subject Specialists and which support NIST research. The Library should also be proactive in checking for the availability of new editions of textbooks that have proved popular in the past.

[4] E.G. Abels and D.L. Barlow, NIST OIS Customer Survey Report, NIST Office of Information Services, 2002, sect. 6.3.2.

[5] Library of Congress, Subject Cataloging Manual: Subject Headings, The Library, Washington, D.C. (2002) p.H2187.

10. Relation to the Core Journals List

In 2002, the NIST Research Library developed a core journals list with input from each of the divisions in the NIST Laboratories. This core journals list is categorized by subject. To compare to this report, the core journal list subjects are most similar to those shown on Table 2, NIST Modified Subclasses Ranked by Score. Based on number of titles per category, core journals rank by subject as follows:

1. Engineering (190 of 650 titles)
2. Physics (175 of 650)
3. Chemistry (111 of 650)
4. Materials Science (87 of 650)
5. Computer Science (85 of 650)

As shown in Table 2, subclasses rank by circulation as follows:

1. Physics
2. Mathematics
3. Chemistry
4. General Engineering
5. Computer Science

In relation to one another, the two lists roughly correlate but show some differences. Some of these differences are attributable to different methods of categorization in the two lists. Table 2 of this study used modified LCC subclasses to categorize materials. This method divided Engineering into a number of smaller categories: General Engineering, Electrical Engineering, and Mechanical Engineering. The core journals list took all of these together, so it is not surprising that the Core Journals category Engineering would rank higher on that list since it was more inclusive than the LCC General Engineering category.

Another difference is with Materials Science, which appears on the core journals list but not on the list from Table 2. This can also be attributed to the structure of LCC, which does not have a separate breakout subclass for Materials Science. Instead, Materials Science in LCC falls within the General Engineering category.

One difference not attributable to different categorization schemas concerns Mathematics. Mathematics stands out strongly as a high use category in this study, but only ranked sixth on the core journals list. Clearly, users turn to the Library book collection for information on Mathematics a great deal, but it is likely that scientists other than mathematicians do this to support research in other areas, rather than as a subject of research itself. Therefore, it is not surprising that few divisions considered Mathematics as a "core" research area when it came to the journal collection.

11. Recommendations for the Library Approval Plan Profile

The NIST Research Library currently uses a book approval plan service. Like most plans, the NIST plan features two types of notification of newly published works: slip and book. For slip notification, the Library receives a brief bibliographic description of the book. Approximately 30 Subject Specialists from the NIST Laboratories review the slips and suggest books to order. For book notification, the Library receives the actual book automatically, on an "approval" basis, which means it can be returned if the Library chooses. The Library's approval plan profile controls which topics are received as slips and which topics are received as books. The profile is structured according to LCC. Once the books are reviewed by Subject Specialists, librarians decide which titles to purchase, taking into account their knowledge of the NIST Laboratories and input from NIST Strategic Working Groups.

The automatic delivery of books on the approval plan is an important part of the acquisition process. Through this method, books that are most pertinent to the research needs of the organization arrive without any proactive effort required by Library staff or Subject Specialists. However, in order for the approval plan to work as intended, the Library must have a book budget that roughly corresponds to the number of books that are sent on approval. When the Library's book acquisitions drop below 500 titles per year, the approval plan becomes difficult to operate. If the budget is too small it becomes a pointless exercise to receive books automatically only to return the great majority. In fiscal year 2004, the Library temporarily suspended automatic delivery due to budget constraints that limited purchases to approximately 350 titles. This suspension has continued into fiscal year 2005 due to lack of funds.

In general, the NIST book approval plan profile is well tailored to the needs of the organization. When activated, book notification is currently concentrated in Physics, Chemistry, General Engineering, Mechanical Engineering, and Telecommunications. This report suggests the need for the following changes to the profile. When book notification is cancelled for a subject, coverage would continue as slip notification.

QA: Mathematics and Computer Science. The Library's profile is set to receive slip notification only across the board. The Library should add book notification coverage for Programming, Software, Computing, Mathematical Statistics, and Mathematical Analysis to cover the call numbers listed on the report.

QC: Physics. The profile is set to receive book notification for almost the entire subclass. This analysis indicates that the Library should scale back book coverage to only cover the specific tight ranges on the report, and convert other ranges to slip notification coverage. Specifically, exclude book coverage for QC200s, covering Acoustics and Sound, and QC500s, covering Instruments and Apparatus of Electricity. Both ranges had no top call numbers.

QD: Chemistry. The profile is set to receive book notification for the entire subclass. The Library should scale back book coverage to only cover the specific tight ranges on the report, and convert other ranges to slip coverage. Due to lack of high circulation, the Library should specifically exclude book coverage for QD600-QD899, covering Radiation Chemistry and Photochemistry.

QP: Biochemistry. Add book notification coverage for QP519.9, Biochemistry Technique. Coverage is slip notification only.

R: Medicine. Add book coverage for R857, Biomedical Engineering. Coverage is slip notification only.

T: Technology and Engineering. The profile has a high rate of book coverage currently. In TH, cancel book notification coverage for TH2401-2495 on Roofs. In TJ, cancel book notification coverage for TJ940-1030 on Vacuum Technology. Cancel book notification for TK454.4 on Electromagnetics. Cancel book notification for numbers in TS on Manufactures. Otherwise keep most book notification coverage in TA (General Engineering), TJ (Mechanical Engineering), TK (Electrical Engineering and Telecommunications) and TP (Chemical Technology).

12. Conclusions

Through the customer survey and through circulation patterns as shown in this report, Library customers have stated that the book collection is an important and highly used resource. This report provides an outline of subject areas in which collection development will almost certainly result in resources that are highly used and generate substantial return on investment (ROI). These subjects include but are not limited to NIST SFAs. They also include many subjects of broad interest to the research community, such as spectroscopy, and of practical utility to bench scientists, such as computer programming.

The results of this report suggest that NIST staff use the book collection to learn about topics that *support* their research, such as programming, research methodology, and statistical analysis, as much if not more than to learn about their specific areas of expertise. Studies of information use by scientists have shown that journals, not books, are the single most important information resource for maintaining current awareness in the fields of science and engineering.[6] At NIST, this study suggests that the book collection is more likely to be used to investigate fields in which the scientist is less familiar, but in which a situational need for more knowledge has occurred. Among the most popular books in the collection are a number of classic textbooks, supporting the thesis that the Library should view the book collection not only as a resource for subject experts, but also for non-experts coming in from outside a discipline to get an introduction to a new topic. In this situation, the customer is unlikely to know ahead of time the title of the book they need; therefore interlibrary loan, often cited as a partial remedy for shrinking book budgets, is an ineffective option for this customer.

In recent fiscal years, budget cuts to the Library have made collection development challenging. As the Library continues to operate with a limited book budget, it is paramount that titles purchased are effective and utilized. The Library's strategic plan for fiscal year 2005 includes developing a measure for new book circulation. In academic libraries, studies have shown that typically as many as 40 % of new books do not circulate within the first three to five years on the shelf.[7] If the Library exceeds this mark, it would be successful compared to many other institutions. But given that the NIST Research Library is focused on the present practical needs of the NIST scientific community, and not on the long term research needs of the typical academic community, the Library should aim for a circulation rate approaching the 100 % level. Table 4, Top 50 Call Numbers for New Books (1999-2004), shows that usage in many areas is very high, but a baseline for circulation of all new acquisitions has not yet been established. The Library can aim to achieve high usage of new acquisitions by close monitoring of circulation of existing resources by its customers. This study represents one attempt to do such monitoring. Repeating this study at frequent intervals would be difficult due to the large volume of data. However, similar smaller studies may be conducted more regularly based on periodic "snap shots" of circulation showing all materials on loan on a given day. The Library will explore this possibility in conjunction with the development of the measurement for new book circulation.

This report illuminates popular subject areas. High usage rates in many of these subjects, especially for new books, shows that the Library's acquisition program has been successful. Input from Subject Specialists and Strategic Working Groups has been effective. The Library has identified what its customers are reading and knows what it should be buying. The Library is ready to make sound purchasing decisions and to measure its performance. The Library book collection should continue to be funded to maintain and improve its current level of success and customer satisfaction.

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[6] Susan Miller, Information-Seeking Behaviour of Academic Scientists in the Electronic Age: a Literature Review, Canadian Research Knowledge Network [web page], http://www.researchknowledge.ca/initiatives/evaluation/LitReview-SusanMiller.pdf [June 2002].

[7] Deborah Blecic, Monograph use at an academic health sciences library: the first three years of shelf life, Bull. Med. Libr. Assoc. **88** (2), 145-151 (2000). Larry Hardesty, Use of library materials at a small liberal arts college: a replication, Coll. Manage. **10** (3-4), 61-80 (1988).

Appendix A. Data Tables

Table 1. LCC Classes Ranked by Score

	LCC Class		Score[a]	Total Transactions	Total Volumes
1	Q	Science	1 256 583.6	151 068	8318
2	T	Technology	213 744.9	58 257	3669
3	R	Medicine	503.1	2795	180
4	H	Social Sciences	441.3	1970	224
5	P	Language and Literature	20.6	527	39
6	Z	Library Science. Information Resources.	16.6	395	42
7	B	Philosophy. Psychology. Religion	13.7	456	30
8	U	Military Science	1.8	91	23
9	G	Geography. Anthropology. Recreation	1.6	132	12
10	S	Agriculture	1.0	61	17
11	J	Political Science	0.9	72	13
12	M	Music	0.7	100	7
13	K	Law	0.2	38	4
14	D	History (General). History of Europe	0.1	29	4
15	N	Fine Arts	0.1	25	4
16	C	Auxiliary Sciences of History	0.1	16	5
17	L	Education	0.1	37	2
18	V	Naval Science	0.0	4	3
19	A	General Works	0.0	10	1

[a] Score = Total Circulation Transactions x Total Circulated Volumes / 1000

Table 2. NIST Modified Subclasses Ranked by Score[a]

	Subclass[b]		Score[c]	Total Transactions	Total Volumes
1	QC	Physics	161 418.5	53 896	2995
2	QA, pt.1	Mathematics	79 105.9	36 404	2173
3	QD	Chemistry	55 626.2	32 473	1713
4	TA	Engineering, General	25 683.5	21 191	1212
5	QA, pt.2	Computer Science	9288.1	14 650	634
6	TK, pt.1	Electrical Engineering	4820.8	8578	562
7	TJ	Mechanical Engineering	3256.3	6461	504
8	TP, pt.1	Chemical Technology, General	2255.3	6537	345
9	TK, pt.2	Telecommunications	1355.9	4808	282
10	QP, pt.1	Biochemistry	1279.0	5374	238
11	Q	Science, General	874.2	3511	249
12	T	Technology, General	645.8	3090	209
13	TS	Manufactures	490.8	2653	185
14	TN	Metallurgy	405.4	2599	156
15	QH, pt.1	Biology, General	189.1	1735	109
16	QH, pt.2	Microscopy	126.6	1666	76
17	R, pt.1	Bioengineering	104.2	1488	70
18	HD	Management	95.7	870	110
19	TH	Building Construction	43.3	577	75
20	QB	Astronomy	31.7	529	60
21	HF	Commerce	31.2	547	57
22	TD	Environmental Technology	27.6	673	41
23	QE	Geology	15.3	478	32
24	QP, pt.2	Physiology, General	9.7	304	32
25	TP, pt.2	Biotechnology	9.6	371	26
26	RC-RF	Medicine, Specialties	9.5	450	21
27	BF	Psychology	8.6	391	22
28	TL, pt.1	Aeronautics and Astronautics	8.0	268	30
29	RM-RS	Pharmacology	7.9	374	21
30	RA, pt.1	Toxicology	7.1	173	41
31	H, HA	Statistics	5.3	250	21

[a] Some LCC subclasses were divided and others combined based on local practice and terminology.
[b] Includes subclasses scoring 5 or higher
[c] Score = Total Circulation Transactions x Total Circulated Volumes / 1000

Table 3. Top 100 Call Numbers for All Books Ranked by Score

Rank	Score[a]	Subject Area	Topic	Call Number[b]	Circ. Trans-actions	Circu-lated Vols.	Circ. Trans. / Circ. Vols.	Available Vols. On Shelf	Usage Rate of Available Vols.
1	550.3	Analytical Chemistry	**Spectrum Analysis, Special**	QD96	3693	149	24.8	262	57 %
2	344.6	Optics. Light	**Spectroscopy, Special**	QC454	2692	128	21.0	274	47 %
3	327.8	Computers and Special Computing	**Computer Topics: Security, Client/Server, Simulation, Natural Language, etc.**	QA76.9[c]	2325	141	16.5	702	20 %
4	281.1	Atomic Physics	**Solids. Solid State Physics**	QC176.8[d]	2037	138	14.8	267	52 %
5	172.1	Programming	**C Programming Languages (C, C++, C#)**	QA76.73 .C15x	2822	61	46.3	83	73 %
6	156.9	Mathematical Statistics	**Mathematical Statistics, General**	QA276	1846	85	21.7	237	36 %
7	109.9	Probabilities	**Probabilities, General**	QA273	1616	68	23.8	235	29 %
8	109.7	Nuclear Physics	**Special Particles, Antiparticles, Families of Particles**	QC793.5	1407	78	18.0	258	30 %
9	104.8	Materials of Engineering	**Polymers**	TA455 .P58	1691	62	27.3	84	74 %
10	103.1	Inorganic Chemistry	**Special Inorganic Elements**	QD181	1375	75	18.3	273	27 %
11	95.8	Electronics	**Semiconductors**	TK7871.85	1330	72	18.5	217	33 %
12	85.1	Organic Chemistry	**Polymers. Macromolecules, General**	QD381	1606	53	30.3	79	67 %
13	84.3	Programming	**Programming Languages**	QA76.73[e]	1533	55	27.9	161	34 %
14	82.2	Biochemistry	**Biochemistry Technique. Analytical Biochemistry, Special.**	QP519.9	1394	59	23.6	124	48 %
15	81.8	Biomedical Engineering	**Bioengineering Topics: Biosensors, Materials, Polymers, etc.**	R857	1320	62	21.3	94	66 %
16	80.4	Physical and Theoretical Chemistry	**Atomic and Molecular Theory and Structure**	QD461	1148	70	16.4	211	33 %

[a] Score = Total Circulation Transactions x Total Circulated Volumes / 1000

[b] Underlined Call Numbers represent numbers that further subdivide into multiple topics. Sample subtopics shown in Table 5

[c] Except QA76.9 .D3 (Database Management) which qualified for scoring independently.

[d] Except QC176.8 .E4 (Electronic States) which qualified for scoring independently.

[e] Except QA76.73 .C15 (C Languages) and .J38 (Java) which qualified for scoring independently.

Rank	Score	Subject Area	Specific Topic	Call Number	Circ. Trans-actions	Circu-lated Vols.	Circ. Trans. / Circ. Vols.	Available Vols. On Shelf	Usage Rate of Available Vols.
17	69.9	Atomic Physics	**Solid State Physics, General**	QC176	1227	57	21.5	189	35 %
18	69.4	Mathematical Physics	**Mathematical Physics, Special**	QC20.7	1036	67	15.5	97	52 %
19	60.1	Electricity	**Semiconductor Physics, Special**	QC611.6	1202	50	24.0	86	55 %
20	58.0	Biochemistry	**Proteins**	QP551	1234	47	26.3	131	44 %
21	56.6	Atomic Physics	**Quantum Theory & Mechanics, General**	QC174.12	871	65	13.4	154	42 %
22	55.9	Electronics	**Microelectronics**	TK7874	1036	54	19.2	325	17 %
23	55.9	Chemical Engineering	**Special Processes & Operations**	TP156	998	56	17.8	217	26 %
24	52.7	Mathematical Statistics	**Nonparametric Methods**	QA279	1053	50	21.1	90	56 %
25	52.3	Mathematical Analysis	**Numerical Analysis**	QA297	968	54	17.9	152	36 %
26	52.1	Programming	**Java Language**	QA76.73 .J38	1211	43	28.2	61	70 %
27	49.2	Mathematical Statistics	**Regression & Correlations Analysis**	QA278.2	1144	43	26.6	74	58 %
28	47.9	Atomic Physics	**Statistical Physics, General**	QC174.8	1114	43	25.9	64	67 %
29	47.8	Atomic Physics	**Matter and Antimatter, Spec.**	QC173.4[f]	1038	46	22.6	143	32 %
30	46.9	Mathematical Statistics	**Multivariate Analysis**	QA278	938	50	18.8	89	56 %
31	46.6	Analytical Chemistry	**Chromatographic Analysis**	QD79 .C4 - QD79 .C8	991	47	21.1	50	94 %
32	44.4	Optics. Light	**Optics, General**	QC355 - QC355.2	1199	37	32.4	65	57 %
33	43.9	Metallography	**Metallography, General**	TN690	1097	40	27.4	144	28 %
34	40.0	Robotics and Automatic Machinery	**Robotics and Automatic Machinery, General**	TJ211	728	55	13.2	114	48 %
35	38.7	Software	**Operating Systems (Windows, Linux, Unix)**	QA76.76 .O63	944	41	23.0	162	25 %
36	38.1	Applied Optics	**Optical Data Processing**	TA1632	976	39	25.0	229	17 %
37	37.8	Atomic Physics	**Quantum Theory & Mechanics, Special**	QC174.17	756	50	15.1	165	30 %
38	34.7	Software	**Software Topics**	QA76.76[g]	722	45	17.2	158	28 %

[f] Except QC173.4 .S94 (Surfaces) which qualified for scoring independently.

[g] Except QA76.76 .E95 (Expert Systems), .H94 (Hypertext Systems) and .O63 (Operating Systems) which qualified for scoring independently.

Table 3

Rank	Score	Subject Area	Specific Topic	Call Number	Circ. Trans-actions	Circu-lated Vols.	Circ. Trans. / Circ. Vols.	Available Vols. On Shelf	Usage Rate of Available Vols.
39	33.8	Probabilities	**Markov Processes & Chains**	QA274.7x	845	40	21.1	82	49 %
40	32.2	Organic Chemistry	**Polymers. Macromolecules, Special Topics**	QD381.9	895	36	24.9	62	58 %
41	32.1	Electronics	**Apparatus and Materials**	TK7872	583	55	10.6	227	24 %
42	31.2	Probabilities	**Distributions.**	QA273.6	822	38	21.6	46	83 %
43	30.3	Heat	**Heat Transfer**	QC320	948	32	29.6	48	67 %
44	29.6	Telecommunication	**Telecommunication, Special**	TK5102.5	988	30	32.9	92	33 %
45	29.4	Mathematical Analysis	**Control Theory**	QA402.3x	577	51	11.3	168	30 %
46	28.3	Analytical Mechanics	**Elasticity. Plasticity**	QA931	808	35	23.1	91	38 %
47	28.0	Mathematical Analysis	**Mathematical Optimization. Programming**	QA402.5	609	46	13.2	151	30 %
48	27.8	Applied Optics	**Image Processing**	TA1637	795	35	22.7	58	60 %
49	27.4	Mechanical Drawing	**Computer Graphics**	T385	762	36	21.2	117	31 %
50	27.4	Electronics	**Materials, Special**	TK7871.15	831	33	25.2	86	38 %
51	27.1	Materials of Engineering	**Composite Materials**	TA418.9 .C6	661	41	16.1	155	26 %
52	26.2	Control Engineering Systems	**Control Engineering Systems, General**	TJ213	494	53	9.3	117	45 %
53	26.0	Heat	**Thermodynamics**	QC311	684	38	18.0	92	41 %
54	24.8	Crystallography	**Crystal Structure and Growth**	QD921	637	39	16.3	150	26 %
55	24.8	Algebra	**Group Theory**	QA171	605	41	14.8	177	23 %
56	24.5	Optics. Light	**Nonlinear & Quantum Optics**	QC446.2	790	31	25.5	48	65 %
57	24.4	Physical and Theoretical Chemistry	**Surface Chemistry**	QD506	764	32	23.9	107	30 %
58	23.2	Atomic Physics	**Quantum Field Theory**	QC174.45	539	43	12.5	113	38 %
59	22.5	Microscopy	**Scanning Microscopes**	QH212 .S3x	704	32	22.0	33	97 %
60	22.0	Analytical Mechanics	**Fluid Dynamics. Hydraulics**	QA911	687	32	21.5	93	34 %
61	21.6	Computers and Special Computing	**Neural Computers & Networks**	QA76.87	721	30	24.0	100	30 %
62	21.3	Mathematical Statistics	**Time Series Analysis**	QA280	644	33	19.5	79	42 %
63	20.7	Radiation Physics	**X-Rays & Roentgen Rays**	QC482	738	28	26.4	40	70 %

Table 3

Rank	Score	Subject Area	Specific Topic	Call Number	Circ. Trans-actions	Circu-lated Vols.	Circ. Trans. / Circ. Vols.	Available Vols. On Shelf	Usage Rate of Available Vols.
64	20.1	Mechanics of Engineering	**Applied Fluid Mechanics**	TA357	772	26	29.7	86	30 %
65	19.8	Atomic Physics	**Electronic States**	QC176.8 .E4	599	33	18.2	98	34 %
66	18.5	Physical and Theoretical Chemistry	**Chemical Reactions**	QD501	543	34	16.0	208	16 %
67	18.4	Analytical Chemistry	**Analytical Chemistry, Special**	QD75.4	736	25	29.4	48	52 %
68	17.7	Cybernetics	**Artificial Intelligence**	Q335	507	35	14.5	112	31 %
69	17.7	Materials of Engineering	**Nonmetallic Materials**	TA455[h]	571	31	18.4	138	22 %
70	17.7	Geometry	**Topology**	QA611	491	36	13.6	106	34 %
71	17.5	Materials of Engineering	**Surface Effects and Tests**	TA418.7	731	24	30.5	49	49 %
72	17.3	Machinery	**Tribology. Lubrication and Friction**	TJ1075	642	27	23.8	82	33 %
73	17.3	Atomic Physics	**Matter and Antimatter, General**	QC173	596	29	20.6	196	15 %
74	17.0	Crystallography	**X-Ray Crystallography**	QD945	630	27	23.3	69	39 %
75	16.8	Mathematical Analysis	**Differential Equations**	QA371	509	33	15.4	152	22 %
76	16.8	Software	**Hypertext Systems (Inc. HTML & XML)**	QA76.76 .H94	670	25	26.8	35	71 %
77	16.7	Computers and Special Computing	**Database Management**	QA76.9 .D3	575	29	19.8	198	15 %
78	16.3	Atomic Physics	**Statistical Physics, Special**	QC174.85	563	29	19.4	52	56 %
79	16.3	Telecommunication	**Optical Communications**	TK5103.59	604	27	22.4	72	38 %
80	16.3	Magnetism	**Magnetism, General**	QC753 - QC753.2	652	25	26.1	39	64 %
81	16.0	Telecommunication	**World Wide Web**	TK5105.888	484	33	14.7	49	67 %
82	15.6	Electricity	**Semiconductors**	QC612 .S4	489	32	15.3	48	67 %
83	15.5	Physical and Theoretical Chemistry	**Physical and Theoretical Chemistry , General**	QD453 - QD453.2	500	31	16.1	92	34 %
84	15.2	Chemistry	**Chemistry, Special Topics**	QD39.3	491	31	15.8	44	70 %

[h] Except TA455 .P58 (Polymers) which qualified for scoring independently.

Table 3

Rank	Score	Subject Area	Specific Topic	Call Number	Circ. Trans-actions	Circu-lated Vols.	Circ. Trans. / Circ. Vols.	Available Vols. On Shelf	Usage Rate of Available Vols.
85	15.2	Engineering Mathematics	**Finite Element Method of Problem Solving**	TA347 .F5	585	26	22.5	50	52 %
86	14.6	Electricity	**Electromagnetic Theory**	QC670	442	33	13.4	77	43 %
87	14.4	Materials of Engineering	**Failure of Materials.**	TA409	464	31	15.0	115	27 %
88	14.3	Electricity	**Semiconductor Physics, General**	QC611	509	28	18.2	70	40 %
89	13.9	Mathematical Analysis	**Partial Differential Equations**	QA377	385	36	10.7	119	30 %
90	13.8	Organic Chemistry	**Polymerization. Telomerization.**	QD281 .P6	532	26	17.6	76	37 %
91	13.8	Physical and Theoretical Chemistry	**Quantum Chemistry**	QD462	494	28	20.5	81	32 %
92	13.1	Telecommunication	**Computer Networks**	TK5105.5	505	26	19.4	144	18 %
93	12.6	Probabilities	**Stochastic Analysis**	QA274.2x	466	27	17.3	52	52 %
94	12.4	Mathematical Analysis	**System Analysis**	QA402	460	27	17.0	118	23 %
95	12.4	Software	**Expert Systems**	QA76.76 .E95	459	27	17.0	116	23 %
96	11.9	Engineering Mathematics	**Computer-Aided Engineering. Data Processing.**	TA345	459	26	17.7	74	35 %
97	11.9	Electricity	**Superconductivity Physics, Spec.**	QC612[i]	497	24	20.7	72	33 %
98	11.5	Nuclear Physics	**Elementary Particle Physics**	QC793.3	409	28	14.6	173	16 %
99	11.5	Atomic Physics	**Surfaces**	QC173.4 .S94	458	25	18.3	68	37 %
100	11.0	Physicists Biographies	**Individual Biographies**	QC16	345	32	10.8	103	31 %

[i] Except QC612 .S4 (Semiconductors) which qualified for scoring independently.

Table 4. Top 50 Call Numbers for New Books (1999-2004) Ranked by Score

Rank	Score[a]	Subject Area	Specific Topic[b]	Call Number[c]	Circ. Trans-actions	Circu-lated Vols.	Circ. Trans. / Circ. Vols.	Available Vols. On Shelf	Usage Rate of Available Vols.
1	100.3	Software	Operating Systems (Windows, Linux, Unix)	QA76.76 .O63	418	24	17.4	25	96 %
2	98.7	Programming	Java Language	QA76.73 .J38	429	23	18.7	23	100 %
3	29.7	Software	Hypertext Systems (Inc. HTML & XML)	QA76.76 .H94	270	11	24.5	11	100 %
4	26.8	Telecommunication	World Wide Web	TK5105.888	149	18	8.3	25	72 %
5	26.2	Materials of Engineering	Nanostructure Materials	TA418.9 .N35	164	16	10.3	16	100 %
6	24.1	Atomic Physics	Solids. Solid State Physics. Special	QC176.8	134	18	7.4	27	67 %
7	17.9	Atomic Physics	Quantum Theory & Mechanics, General	QC174.12	138	13	10.6	21	62 %
8	15.6	Software	Software Topics, Special	QA76.76[d]	120	13	9.2	54	24 %
9	13.5	Analytical Chemistry	Spectrum Analysis, Special	QD96	123	11	11.2	15	73 %
10	13.4	Computers and Special Computing	Computer Topics, Special	QA76.9[e]	103	13	7.9	30	43 %
11	12.8	Computers and Special Computing	Database Management	QA76.9 .D3	128	10	12.8	12	83 %
12	12.2	Technology, General	Nanotechnology	T174.7	111	11	10.1	14	79 %
13	12.0	Mathematical Statistics	Bayesian Statistics	QA279.5	133	9	14.8	12	75 %
14	11.7	Engineering Mathematics	Computer-Aided Engineering. Data Processing.	TA345	130	9	14.4	9	100 %
15	11.4	Electronics	Semiconductors	TK7871.85	95	12	7.9	13	92 %
16	11.4	Telecommunication	Signal Processing	TK5102.9	142	8	17.8	9	89 %
17	10.8	Programming	Programming Languages	QA76.73[f]	154	7	22	9	78 %

[a] Score = Total Circulation Transactions x Total Circulated Volumes / 100

[b] Specific Topics shown in shade are topics that did not appear in the list of Top 100 Call Numbers for All Books. These should be considered emerging topics of interest to the NIST community in the period 1999-2004.

[c] Underlined Call Numbers represent numbers that further subdivide into multiple topics. Sample subtopics shown in Table 5.

[d] Except QA76.76 .H94 (Hypertext Systems) and .O63 (Operating Systems) which qualified for scoring independently.

[e] Except QA76.9 .C55 (Client/Server), .D26 (Database Design), .D3 (Database Management), and .O35 (Object-Oriented Methods) which qualified for scoring independently.

[f] Except QA76.73 .C15x (C Languages), .B3 (Visual Basic), and .J38 (Java) which qualified for scoring independently.

Rank	Score	Subject Area	Specific Topic	Call Number	Circ. Trans-actions	Circu-lated Vols.	Circ. Trans. / Circ. Vols.	Available Vols. On Shelf	Usage Rate of Available Vols.
18	10.3	Electronics	Microelectromechanical Systems	TK7875	79	13	6.1	15	87 %
19	9.2	Biomedical Engineering	Biomedical Engineering, General	R857[g]	132	7	18.9	10	70 %
20	8.5	Atomic Physics	Matter and Antimatter, Special	QC173.4	94	9	10.4	20	45 %
21	8.3	Applied Optics	Image Processing	TA1637	75	11	6.8	12	92 %
22	7.8	Optics. Light	Nonlinear & Quantum Optics	QC446.2	98	8	12.3	10	80 %
23	7.5	Optics. Light	Spectroscopy, Special	QC454	83	9	9.2	11	82 %
24	7.1	Materials of Engineering	Materials of Special Composition	TA418.9[h]	71	10	7.1	10	100 %
25	6.3	Mathematical Statistics	Nonparametric Methods	QA279	79	8	9.9	24	33 %
26	5.8	Atomic Physics	Statistical Physics, Special	QC174.85	83	7	11.9	7	100 %
27	5.6	Physical and Theoretical Chemistry	Quantum Chemistry	QD462	111	5	22.2	5	100 %
28	5.3	Physical and Theoretical Chemistry	Physical and Theoretical Chemistry , General	QD453 - QD453.2	106	5	21.2	5	100 %
29	5.3	Telecommunication	TCP/IP	TK5105.585	88	6	14.7	8	75 %
30	5.3	Telecommunication	Active Server Pages	TK5105.8885 .A26	75	7	10.7	7	100 %
31	5.1	Mechanical Drawing	Computer Graphics	T385	73	7	10.4	9	78 %
32	4.9	Optics. Light	Optics, General	QC355.2	122	4	30.5	4	100 %
33	4.9	Biomedical Engineering	Biomedical Materials	R857 .M3	97	5	19.4	5	100 %
34	4.8	Organic Chemistry	Polymers. Macromolecules, Special	QD381.9	80	6	13.3	6	100 %
35	4.8	Computers and Special Computing	Object Oriented Methods	QA76.9 .O35	95	5	19.0	6	83 %
36	4.6	Programming	C Programming Languages (C, C++, C#)	QA76.73 .C15x	57	8	7.1	9	89 %
37	4.5	Biochemistry	Proteins	QP551	113	4	28.3	5	80 %
38	4.4	Analytical Chemistry	Methods of Analysis	QD79	73	6	12.2	6	100 %

[g] Except R857 .M3 (Biomedical Materials) which qualified for scoring independently.

[h] Except TA418.9 .N35 (Nanostructure Materials) which qualified for scoring independently.

Table 4

Rank	Score	Subject Area	Specific Topic	Call Number	Circ. Trans-actions	Circu-lated Vols.	Circ. Trans. / Circ. Vols.	Available Vols. On Shelf	Usage Rate of Available Vols.
39	4.3	Materials of Engineering	Polymers	TA455 .P58	86	5	17.2	6	83 %
40	4.3	Computers	Quantum Computers	QA76.889	85	5	17.0	10	50 %
41	4.2	Electronics	Microelectronics	TK7874	70	6	11.7	8	75 %
42	4.1	Computers	Client/Server Computing	QA76.9 .C55	82	5	16.4	6	83 %
43	4.1	Materials of Engineering	Carbon	TA455 .C3	58	7	8.3	8	88 %
44	4.1	Probabilities	Probabilities, General	QA273	81	5	16.2	12	42 %
45	3.9	Machinery	Tribology. Lubrication and Friction	TJ1075	78	5	15.6	5	100 %
46	3.8	Science Research	Research, Special Topics	Q180.55	63	6	10.5	15	40 %
47	3.8	Organic Chemistry	Polymers, Special Types	QD382	63	6	10.5	6	100 %
48	3.8	Physical and Theoretical Chemistry	Atomic and Molecular Theory and Structure	QD461	63	6	10.5	8	75 %
49	3.7	Computers and Special Computing	Database Design	QA76.9 .D26	92	4	23.0	4	100 %
50	3.5	Programming	Visual Basic	QA76.73 .B3	116	3	38.7	3	100 %

Table 4

Table 5. Top Call Numbers Arranged by Call Number

Call Number[a]	Rank[b]	Subject Area	Specific Topic
Q180.55	46n	Science Research	Special Topics in Research (Methodology, Statistical Methods, Proposal Writing, etc.)
Q335	68a	Cybernetics	Artificial Intelligence
QA76.73	13a, 17n	Programming	Programming Languages (Fortran, Basic, SQL, etc.)
QA76.73 .B3	50n	Programming	Visual Basic
QA76.73 .C15x	5a, 36n	Programming	C Programming Languages (C, C++, C#)
QA76.73 .J38	26a, 2n	Programming	Java Language
QA76.76	38a, 8n	Software	Software Topics (Development, Software Testing, Windows, etc.)
QA76.76 .E95	95a	Software	Expert Systems
QA76.76 .H94	76a, 3n	Software	Hypertext Systems (Includes HTML & XML)
QA76.76 .O63	35a, 1n	Software	Operating Systems (Windows, Linux, Unix)
QA76.87	61a	Computers and Special Computing	Neural Computers & Networks
QA76.889	40n	Computers and Special Computing	Quantum Computers
QA76.9	3a, 10n	Computers and Special Computing	Computer Topics (Security/Access Control, Client/Server, Simulation, Natural Language, etc.)
QA76.9 .C55	42n	Computers and Special Computing	Client/Server Computing
QA76.9 .D26	49n	Computers and Special Computing	Database Design
QA76.9 .D3	77a, 11n	Computers and Special Computing	Database Management
QA76.9 .O35	35n	Computers and Special Computing	Object-Oriented Methods
QA171	55a	Algebra	Group Theory
QA273	7a, 44n	Probabilities	Probabilities, General
QA273.6	42a	Probabilities	Distributions.
QA274.2 - QA274.28	93a	Probabilities	Stochastic Analysis
QA274.7x	39a	Probabilities	Markov Processes & Chains
QA276	6a	Mathematical Statistics	Mathematical Statistics, General
QA278	30a	Mathematical Statistics	Multivariate Analysis
QA278.2	27a	Mathematical Statistics	Regression & Correlations Analysis

[a] Underlined Call Numbers represent numbers that further subdivide into subtopics. Sample subtopics are listed in parentheses following Specific Topic.

[b] In the column Rank, the numbers followed by *"a"* represent the ranking in Table 3 for All Books, and numbers followed by *"n"* represent the ranking in Table 4 for New Books.

Call Number	Rank	Subject Area	Specific Topic
QA279	24a, 25n	Mathematical Statistics	Nonparametric Methods
QA279.5	13n	Mathematical Statistics	Bayesian Statistics
QA280	62a	Mathematical Statistics	Time Series Analysis
QA297	25a	Mathematical Analysis	Numerical Analysis
QA371	75a	Mathematical Analysis	Differential Equations
QA377	89a	Mathematical Analysis	Partial Differential Equations
QA402	94a	Mathematical Analysis	System Analysis
QA402.3x	45a	Mathematical Analysis	Control Theory
QA402.5	47a	Mathematical Analysis	Mathematical Optimization. Programming
QA611	70a	Geometry	Topology
QA911	60a	Analytic Mechanics	Fluid Dynamics. Hydraulics
QA931	46a	Analytic Mechanics	Elasticity. Plasticity
QC16	100a	Physicists Biographies	Individual Biographies (Einstein, Heisenberg, Kelvin, etc.)
QC20.7	17a	Mathematical Physics	Mathematical Physics, Special (Density Functionals, Differential Geometry, Spinor Analysis, Group Theory, etc.)
QC173	73a	Atomic Physics	Matter and Antimatter, General
QC173.4	29a, 20n	Atomic Physics	Matter and Antimatter, Special (Condensed Matter, Polymers, Critical Phenomena, etc.)
QC173.4 .S94	99a	Atomic Physics	Surfaces
QC174.12	21a, 7n	Atomic Physics	Quantum Theory & Mechanics, General
QC174.17	37a	Atomic Physics	Quantum Theory & Mechanics, Special (Chaos, Mathematical Logic, Path Integrals, Many-Body Problem, etc.)
QC174.45	58a	Atomic Physics	Quantum Field Theory
QC174.8	28a	Atomic Physics	Statistical Physics, General
QC174.85	78a, 26n	Atomic Physics	Statistical Physics, Special (Monte Carlo Method, Percolation, etc.)
QC176	16a	Atomic Physics	Solids, Solid State Physics. General
QC176.8	6n	Atomic Physics	Solids, Solid State Physics. Special (Optical Properties, Radiation Effects, Nanostructures, etc.)
QC176.8 .E4	65a	Atomic Physics	Electronic States
QC311	53a	Heat	Thermodynamics
QC320	43a	Heat	Heat Transfer

Call Number	Rank	Subject Area	Specific Topic
QC355 - QC355.2	32a, 32n	Optics. Light	Optics, General
QC446.2	56a, 22n	Optics. Light	Nonlinear & Quantum Optics
QC454	2a, 23n	Optics. Light	Spectroscopy, Special (Atomic, Electron, Laser, Molecular, etc.)
QC482	63a	Radiation Physics	X-Rays & Roentgen Rays (Diffraction, Spectroscopy, Scattering, etc.)
QC611	88a	Electricity	Semiconductor Physics, General
QC611.6	18a	Electricity	Semiconductor Physics, Special (Defects, Hot Carriers, Optical Effects, Surface Properties, etc.)
QC612	97a	Electricity	Superconductivity Physics, Special
QC612 .S4	82a	Electricity	Semiconductors
QC670	86a	Electricity	Electromagnetic Theory
QC753 - QC753.2	80a	Magnetism	Magnetism, General
QC793.3	98a	Nuclear Physics	Elementary Particle Physics (Angular Momentum, Field Theories, Structure, etc.)
QC793.5	8a	Nuclear Physics	Special Particles, Antiparticles, Families of Particles (Electrons, Neutrons, Photons, etc.)
QD39.3	84a	Chemistry	Chemistry, Special Topics (Mathematics, Statistical Methods, Factor Analysis, Cheminformatics, etc.)
QD75.4	67a	Analytical Chemistry	Analytical Chemistry, Special (Quality Control, Statistical Methods, Electronic Data Processing, etc.)
QD79	38n	Analytical Chemistry	Methods of Analysis (Instrumental Analysis, Thermal Analysis)
QD79 .Cx	31a	Analytical Chemistry	Chromatographic Analysis
QD96	1a, 9n	Analytical Chemistry	Spectrum Analysis, Special Types of Spectroscopy (Spectroscopy: Fluorescence, Fourier Transform, Infrared, Mass, Nuclear Magnetic Resonance)
QD181	10a	Inorganic Chemistry	Special Inorganic Elements (Carbon, Oxides, Silicon, etc.)
QD281 .P6	90a	Organic Chemistry	Polymerization. Telomerization.
QD381	12a	Organic Chemistry	Polymers. Macromolecules, General
QD381.9	40a, 34n	Organic Chemistry	Polymers. Macromolecules, Special Topics (Electric Properties, Rheology, Solubility, Surfaces, etc.)
QD382	47n	Organic Chemistry	Polymers. Macromolecules, Special Types (Conductors, Crystalline, Water-Soluble, etc.)
QD453 - QD453.2	83a, 28n	Physical and Theoretical Chemistry	Physical and Theoretical Chemistry, General
QD461	16a, 48n	Physical and Theoretical Chemistry	Atomic and Molecular Theory and Structure

Table 5

Call Number	Rank	Subject Area	Specific Topic
QD462	91a, 27n	Physical and Theoretical Chemistry	Quantum Chemistry
QD501	66a	Physical and Theoretical Chemistry	Chemical Reactions
QD506	57a	Physical and Theoretical Chemistry	Surface Chemistry
QD921	54a	Crystallography	Crystal Structure and Growth
QD945	74a	Crystallography	X-Ray Crystallography
QH212 .S3x	59a	Microscopy	Scanning Microscopes
QP519.9	14a	Biochemistry	Biochemistry Technique. Analytical Biochemistry, Special (Affinity Chromatography, Mass Spectrometry, Spectroscopy, Nuclear Magnetic Resonance Spectroscopy, etc.)
QP551	19a, 37n	Biochemistry	Proteins
R857	15a, 19n	Biomedical Engineering	Biomedical Engineering (Biosensors, Biomedical Materials, Polymers, etc.)
R857 .M3	33n	Biomedical Engineering	Biomedical Materials
T174.7	12n	Technology, General	Nanotechnology
T385	49a, 31n	Mechanical Drawing	Computer Graphics
TA345	96a, 14n	Engineering Mathematics	Computer-Aided Engineering. Data Processing.
TA347 .F5	85a	Engineering Mathematics	Finite Element Method of Problem Solving
TA357	64a	Mechanics of Engineering	Applied Fluid Mechanics
TA409	87a	Materials of Engineering	Failure of Materials.
TA418.7	71a	Materials of Engineering	Surface Effects and Tests
TA418.9	24n	Materials of Engineering	Materials of Special Composition (Nanostructure Materials, Composite Materials, Smart Materials, etc.)
TA418.9 .C6	51a	Materials of Engineering	Composite Materials
TA418.9 .N35	5n	Materials of Engineering	Nanostructure Materials
TA455	69a	Materials of Engineering	Nonmetallic Materials (Carbon, Ceramics, Plastics, etc.)
TA455 .C3	43n	Materials of Engineering	Carbon
TA455 .P58	9a, 39n	Materials of Engineering	Polymers
TA1632	36a	Applied Optics	Optical Data Processing
TA1637	48a, 21n	Applied Optics	Image Processing

Table 5

Call Number	Rank	Subject Area	Specific Topic
TJ211	34a	Robotics and Automatic Machinery	Mechanical Devices. Automata. Robots, General
TJ213	52a	Robotics and Automatic Machinery	Control Engineering Systems
TJ1075	72a, 45n	Machinery	Tribology. Lubrication and Friction
TK5102.5	44a	Telecommunication	Telecommunication, Special (Digital Signal Processing, etc.)
TK5102.9	16n	Telecommunication	Signal Processing
TK5103.59	79a	Telecommunication	Optical Communications
TK5105.5	92a	Telecommunication	Computer Networks, General
TK5105.585	29n	Telecommunication	TCP/IP
TK5105.888	81a, 4n	Telecommunication	World Wide Web
TK5105.8885 .A26	30n	Telecommunication	Active Server Pages
TK7871.15	50a	Electronics	Materials, Special (Ceramic Materials, Gallium, Silicon, Films, etc.)
TK7871.85	11a, 15n	Electronics	Semiconductors
TK7872	41a	Electronics	Apparatus and Materials
TK7874	22a, 41n	Electronics	Microelectronics
TK7875	18n	Electronics	Microelectromechanical Systems
TN690	33a	Metallography	Metallography, General
TP156	23a	Chemical Engineering	Special Processes & Operations (Coating, Emulsion, Mixing, Polymerization, etc.)

Table 5

Table 6. Top 30 Most Circulated Titles for All Books

Rank	Trans-actions	Title	Call Number[a]	Subject Area -- Specific Topic[b]
1	157	The Waite Group's C++ programming / John Thomas Berry.	**QA76.73 .C15** B47 1992	**Programming -- C/C++ Language**
2	155	Applied regression analysis / N.R. Draper, H. Smith.	**QA278.2** .D7 1981	**Mathematical Statistics – Regression & Correlations Analysis**
3	143	Probability and measure / Patrick Billingsley.	**QA273** .B575 1979	**Probabilities – Probabilities, General**
4	140	The C programming language / Brian W. Kernighan, Dennis M. Ritchie.	**QA76.73 .C15** K47 1988	**Programming -- C/C++ Language**
5	138	Numerical recipes : the art of scientific computing / William H. Press ... [et al.].	**QA297** .N866 1986	**Mathematical Analysis – Numerical Analysis**
6	135	Diffusion and heat transfer in chemical kinetics [by] David A. Frank-Kamenetskii. Translation editor: John P. Appleton.	QD543 .F6413 1969	**Physical and Theoretical Chemistry** -- Solubility, Diffusion, etc.
7	130	Magnetochemistry / by Pierce W. Selwood.	QD591 .S45 1956	**Physical and Theoretical Chemistry** -- Magnetochemistry
8	121	The C book, featuring the draft ANSI C standard / Mike Banahan.	**QA76.73 .C15** B36 1988	**Programming -- C/C++ Language**
9	120	Rheological techniques / R. W. Whorlow.	QC189.5 .W48 1980	**Atomic Physics** -- Rheology
10	119	C, a reference manual / Samuel P. Harbison, Guy L. Steele, Jr.	**QA76.73 .C15** H38 1991	**Programming -- C/C++ Language**
11	117	The fast Fourier transform [by] E. Oran Brigham.	QA403 .B74 1974	**Mathematical Analysis** -- Harmonic Analysis
12	116	Elsevier's dictionary of science and technology. Russian-English / compiled by G. Chakalov.	Q123 .C4817 1993	Science --Dictionaries
13	116	Ion bombardment modification of surfaces : fundamentals and applications / edited by Orlando Auciello, Roger Kelly.	**TA418.7** .I65 1984	**Materials of Engineering** -- Surface Effects and Tests
14	115	Mathematical methods for physicists / George Arfken.	QA37.2 .A74 1970	Mathematics--Textbooks
15	115	Neutron diffraction / by G. E. Bacon.	**QC793.5** .N4628 B3 1975	**Nuclear Physics -- Special Particles, Antiparticles, Families of Particles**
16	111	pH measurements / C. Clark Westcott.	QD561 .W52 1978	**Physical and Theoretical Chemistry** -- Electrochemistry, Ions and Ionization
17	110	Polymers and neutron scattering / Julia S. Higgins and Henri C. Benoit.	**QC173.4** .P65 H54 1994	**Atomic Physics** -- Polymers, Properties

[a] Call numbers shown in **bold** are those that appeared on the list of Top Call Numbers in Table 5.

[b] Subject Divisions and Specific Topics shown in **bold** are those that appeared on the list of Top Call Numbers in Table 5.

Rank	Trans-actions	Title	Call Number	Subject Area – Specific Topic
18	109	Programmer's guide to Fortran 90 / Walter S. Brainerd, Charles H. Goldberg, Jeanne C. Adams.	**QA76.73** .F25 B72 1990	**Programming** -- Fortran
19	109	Glow discharge processes : sputtering and plasma etching / Brian Chapman.	QC702.7 .P6 C48 1980 C.2	**Electricity** -- Positive Ions
20	108	Introduction to matrix computations [by] G. W. Stewart.	QA188 .S7 1973	**Algebra** -- Matrices
21	107	The theory of atomic structure and spectra / Robert D. Cowan.	**QC173** .C693 1981	**Atomic Physics -- Matter and Antimatter, General**
22	107	Handbook of optics / sponsored by the Optical Society of America ; Walter G. Driscoll, editor, William Vaughan, associate editor.	QC369 .H35 1978	**Optics. Light** -- Handbooks
23	105	Viscosity of polymer solutions / Miloslav Bohdanecky and Josef Kovar.	QD381.8 .B63 1982	**Organic Chemistry** -- Polymers
24	105	Secondary ion mass spectrometry : basic concepts, instrumental aspects, applications, and trends / A. Benninghoven, F.G. Rudenauer, H.W. Werner.	**QD96** .S43 B46 1987	**Analytical Chemistry -- Spectrum Analysis, Special**
25	105	Particle size measurement / Terence Allen.	TA418.8 .A43 1990	**Materials of Engineering** -- Particle Size Determination
26	104	The C programming language / Brian W. Kernighan, Dennis M. Ritchie.	**QA76.73 .C15** K47 1988	**Programming -- C/C++ Language**
27	104	Transport phenomena / R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot.	QA929 .B5 1960	**Analytic Mechanics** -- Fluid Dynamics Viscous Fluids
28	104	Fundamentals of heat transfer / Frank P. Incropera, David P. DeWitt.	**QC320** .I45 1981	**Heat -- Heat Transfer**
29	104	An introduction to crystal chemistry / by R.C. Evans.	QD905 .E83 1964	**Crystallography** -- General Works
30	104	The properties of gases and liquids / Robert C. Reid, John M. Prausnitz, Thomas K. Sherwood.	TP242 .R4 1977	Chemicals -- Gases

Table 7. Top 30 Most Circulated Titles for New Books (1999-2004)

Rank	Trans-actions	Title	Call Number[a]	Subject Area – Specific Topic[b]
1	65	Beginning Visual basic SQL server 7.0 / Thearon Willis.	**QA76.9 .C55** W53 2000	**Computer Systems and Spc. Computing -- Client/Server Computing**
2	62	UML distilled : a brief guide to the standard object modeling language / Martin Fowler with Kendall Scott ; [foreword by Grady Booch, Ivar Jacobson, and James Rumbaugh].	**QA76.9 .O35** F694 2000	**Computer Systems and Spc. Computing -- Object-Oriented Methods**
3	60	Programming Microsoft Visual Basic 6.0 / Francesco Balena ; [foreword by James Fawcette].	**QA76.73 .B3** B345 1999	Programming -- Visual Basic
4	57	Introduction to superstrings and M-theory / Michio Kaku.	QC794.6 .S85 K35 1999	**Nuclear Physics** -- String Models
5	55	Object-oriented software development in Java: principles, patterns, and frameworks / Xiaoping Jia.	QA76.64 .J53 2000	**Programming** -- Object-Oriented Programming
6	54	Organic chemistry.	QD253 .S65 2000	**Organic Chemistry -- Textbooks**
7	53	Introduction to surface and thin film processes / John A. Venables.	QC176.83 .V46 2000	**Atomic Physics** – Thin Films
8	52	Free boundary problems : theory and applications / I. Athanasopoulos, G. Makrakis, J.F. Rodrigues, editors.	TA347 .B69 F743 1999	**Engineering Mathematics** – Boundary Value Problems
9	50	Mastering database programming with Visual Basic 6 / Evangelos Petroutsos.	**QA76.73 .B3** P49 2000	**Programming -- Visual Basic**
10	50	Joe Celko's SQL for smarties : advanced SQL programming / Joe Celko..	**QA76.73** .S67 C44 2000	**Programming** -- SQL Programming
11	49	LabVIEW applications and solutions / Rahman Jamal, Herbert Pichlik.	Q185 .J36 1999	Science Instruments and Apparatus -- General Works
12	49	XML and Java: developing Web applications / Hiroshi Maruyama, Kent Tamura, Naohiko Uramoto.	**QA76.76 .H94** M28 1999	**Software -- Hypertext Systems**
13	49	Colossal magnetoresistive oxides / edited by Yoshinori Tokura.	QC610.7 .C653 2000	**Electricity** -- Magnetoresistance
14	48	Java look and feel design guidelines / Sun Microsystems, Inc.	**QA76.73 .J38** J373 2001	**Programming -- Java Language**
15	46	Radiation detection and measurement / Glenn F. Knoll.	QC787 .C6 K56 2000	**Nuclear Physics** -- Counters (Instrument)

[a] Call numbers shown in **bold** are those that appeared on the list of Top Call Numbers in Table 5.

[b] Subject Divisions and Specific Topics shown in **bold** are those that appeared on the list of Top Call Numbers in Table 5.

Rank	Trans-actions	Title	Call Number	Subject Area – Specific Topic
16	46	Introduction to high energy physics / Donald H. Perkins.	QC793.2 .P47 2000	**Nuclear Physics** -- Elementary Particle Physics
17	46	Handbook of property estimation methods for environmental chemicals : environmental and health sciences / [edited by] Robert S. Boethling, Donald Mackay.	QD271 .H3186 2000	**Organic Chemistry** -- Organic Analysis
18	46	Circular dichroism : principles and applications / edited by Nina Berova, Koji Nakanishi, Robert W. Woody.	QD473 .C57 2000	**Physical and Theoretical Chemistry** -- Physical Properties in Relation to Structure
19	46	Handbook of biomaterials evaluation: scientific, technical, and clinical testing of implant materials / editor, Andreas F. von Recum.	**R857 .M3** H35 1999	**Biomedical Engineering – Biomedical Materials**
20	45	Guide to Linux installation and administration / Nicholas Wells with Michael Jang.	**QA76.76 .O63** W45 2000	**Software – Operating Systems (Windows, Linux, Unix)**
21	45	Chemical-mechanical polishing-- fundmentals and materials issues : symposium held ...	TS654.5 .C48 2000	Metal Manufactures -- Electrolytic Polishing
22	44	Designing flexible object-oriented systems with UML / Charles Richter.	QA76.64 .R535 1999	**Programming** -- Object-oriented programming
23	44	Java programming : advanced topics / Joe Wigglesworth and Paula Lumby.	**QA76.73 .J38** W54 2000	Programming -- Java Language
24	44	Principles of optics : electromagnetic theory of propagation, interference and diffraction of light / Max Born and Emil Wolf ; with contributions by A.B. Bhatia ... [et al.].	**QC355.2** .B67 1999	**Optics. Light – Optics, General**
25	44	Quantum chemistry : fundamentals to applications / Tams Veszpremi and Miklos Feher.	**QD462** .V48 1999	**Physical and Theoretical Chemistry – Quantum Chemistry**
26	44	Principles and techniques of practical biochemistry / edited by Keith Wilson and John Walker.	QP519.7 .P75 2000	**Biochemistry** -- Biochemistry Technique. Analytical Biochemistry, Gen.
27	43	Condensed matter physics / Michael P. Marder.	**QC173.454** .M37 2000	**Atomic Physics -- Condensed Matter Physics**
28	43	Time-frequency/time scale analysis / Patrick Flandrin ; translated from the French by Joachim Stockler.	**TK5102.9** .F5513 1999	**Telecommunication -- Signal Processing**

Table 7

Rank	Trans-actions	Title	Call Number	Subject Area – Specific Topic
29	42	The pragmatic programmer : from journeyman to master / Andrew Hunt, David Thomas ; [foreword by Ward Cunningham].	**QA76.6** .H857 2000	**Programming – Programming, General**
30	42	Rapid application development with Visual Basic 6 / David McMahon.	**QA76.76** .A65 M425 2000	**Software** -- Application Software

Table 7